

Appl. No. 10/702,181
Amendt. dated September 9, 2005
Reply to Office Action of May 11, 2005

REMARKS / ARGUMENTS

In response to the First Office Action of May 11, 2005, Applicants have amended the application to resolve concerns raised by the Examiner. Reconsideration and allowance of the pending, amended claims are respectfully requested.

I. Invention Overview

The invention is a performance enhancing break-in method for a proton exchange membrane ("PEM") fuel cell that includes cycling potentials of an anode electrode and/or a cathode electrode from a first potential to a second potential and back to the first potential, and repeating the cycling for one or both electrodes for at least two electrode cycles. The potential cycling may be achieved by applying a direct current from a programmable direct current power source to the electrodes. Alternatively the potential cycling may be achieved by varying reactants to which the anode and cathode electrodes are exposed. The break-in method significantly shortens an amount of time necessary to bring the fuel cell up to maximum operational capacity.

II. Response to Office Action

In the May 11, 2005 First Office Action, the Examiner has required affirmation of a provisional election to prosecute

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method claims 1 - 9. Applicants hereby affirm that election, and by this Amendment, non-elected claims 10 and 11 have been canceled.

Next, the Examiner has rejected claims 1-2, 4-6 and 8-9 as being anticipated under 35 U.S.C. Sec. 102(b) by U.S. Patent 5,601,936 to Dudfield et al. Dudfield et al. show a fuel method and system for decontaminating a fuel cell from catalyst poisoning primarily by carbon monoxide. The method of Dudfield et al. includes applying a limited potential to electrodes of a fuel cell from a stored power source for a very limited duration, namely not greater than 0.25 seconds, while a normal power circuit for electrical current generated by the fuel cell is closed.

In contrast, the applicants' claimed invention seeks to achieve a different goal through a significantly different method. Applicants' performance enhancing break-in method seeks to enhance the performance of the fuel cells, not between operational periods, but instead during a break-in period. A significant distinction between the methods of Dudfield et al. is that during the cycling of the potentials of the electrodes of Applicants' fuel cells, opposed electrodes of the fuel cell are exposed to dissimilar gasses, namely an inert and a reactant gas. By the present amendment, that significant distinction has been amended into the two pending independent claims, Claims 1 and 5.

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In particular, Claim 1 now requires that an electrode selected for cycling of a potential for an electrode cycle be "exposed to an inert gas", while the non-selected electrode is "exposed to a gas selected from the group consisting of a hydrogen containing gas, a reducing fluid reactant, and a mixture of a reducing fluid and an inert gas". Claim 5 has similarly been amended to require that the opposed electrodes be exposed to the identified, contrasting inert and reactant gasses during the cycling of a potential of a particular electrode.

Antecedent bases for those amendments are found in the Specification at page 8, Table 1, page 9, Table 2, at page 10, lines 19 - 34, and at page 14, lines 1 - 7, wherein it is pointed out that the "reducing fluid utilized may also be either as low as about 4 percent hydrogen, or as high as pure hydrogen." Because of those amendments to independent Claims 1 and 5, dependent Claims 3, 4, 7, 8 and 9 had to also be amended to establish correct articles with respect to changed antecedent bases for specific words. Also, Claims 3 and 7 were amended by adding the word "first" to clarify a sequence of steps with respect to the amendments to Claim 1 and 5. Additionally, claims 4 and 8 have been amended so that they more accurately correspond to the description of the "varying reactant embodiment" of the invention described in the specification. Antecedent bases for the amendments to Claims 4 and 8 are found in the specification at page 9, Table 2, at page 12, lines 1 - 22, and at page 14, lines 1-7.

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Because Dudfield et al. fail to show or suggest potential cycling of fuel cell electrodes while at least one electrode is exposed to an inert gas and the other electrode is exposed to a non-inert, reactant gas, it is urged that Dudfield et al. does not anticipate or suggest the inventions disclosed in Applicants' amended claims 1-2, 4-6 and 8-9. Therefore, it is respectfully requested that Dudfield et al. be removed as a reference, and that those claims be allowed.

Next, the Examiner has rejected claims 3 and 7 as being unpatentable over Dudfield et al. in light of U.S. Patent 6,576,356 to Hallum. In particular, the Examiner stated that "at the time of the invention it would have been obvious to a person of ordinary skill in the art to include the use of an inert gas provided to the cathode during preconditioning of the fuel cell stack as taught by Hallum in the Dudfield et al. reference in order to prevent electrochemical reactions from occurring in the fuel cells."

It is pointed out that Hallum specifically discloses use of an inert gas on both the anode and cathode electrodes at the same time. At Col. 3, lines 54 - 56, Hallum recites: "Still referring to FIG. 3, after the stack 22 is preheated, the technique 100 includes flowing (block 104) an inert gas through the anode and cathode regions of the stack 22." (See also Col. 2, lines 55 - 58, and FIG. 3, block 104.) Nothing in Hallum or Dudfield et al. show or suggest use of an inert gas on one electrode and usage of a non-inert, reactant gas on the opposed

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electrode.

As evidenced in particular by the "Varying Reactant" embodiment of Applicants' invention (see Page 9 Table 2 of the specification) as now claimed by the amended claims and described in the specification, it is the contrasting inert gas and reactant gas on the opposed electrodes that actually serve to generate cycling of the potentials of the electrodes. Similarly, in the "Applied Voltage" embodiment as described at page 8, Table 1 and page 12 of the specification, it is clear that the provision of the contrasting gases on the opposed electrodes, wherein one gas is a reactant gas and the other is an inert gas, gives rise, in combination with the applied voltages, to the specific cycling of potentials of the particular electrode being cycled. This could not be achieved with simply an inert gas on both electrodes.

Because Hallum does not disclose use of contrasting inert and reactant gasses on opposed electrodes as now claimed by Applicants' amended independent Claims 1 and 5, it is urged that it would therefore not have been obvious to use the inert gas of Hallum on only one electrode of Dudfield et al. By the present amendments to all pending independent claims, Claims 1 and 5, Applicants have now clarified a substantial distinction of their performance enhancing break-in method over the methods shown in Dudfield et al. and in Hallum. Consequently, it is requested that the rejection of Claims 3 and 7 be removed.

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III. Conclusion

By the present amendments to all pending independent claims, Claims 1 and 5, Applicants have thoroughly distinguished their invention over both Dudfield et al. and Hallum. Consequently, the independent Claims 1 and 5 are urged to be allowable. Because the dependent claims further narrow now allowable independent Claims 3 and 5, it is asserted that the dependent claims are now allowable as well. Accordingly, it is respectfully requested that the Examiner remove the rejections of the pending claims, and issue a Notice of Allowance.

Respectfully submitted,
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